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IS 15961 (2012): Hot Dip Aluminium-Zinc Alloy Metallic Coated Steel Strip and Sheet (Plain) [MTD 4: Wrought Steel Products]

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Indian Standard

HOT DIP ALUMINIUM-ZINC ALLOY METALLIC COATED STEEL STRIP AND SHEET (PLAIN)

ICS 77.140.50

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

May 2012 **Price Group 3**

Wrought Steel Products Sectional Committee, MTD 4

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Wrought Steel Products Sectional Committee had been approved by the Metallurgical Engineering Division Council.

Till recently, there used to be 100 percent import of hot-dip aluminium-zinc alloy metallic coated steel strip and sheet. Now local production has started and number of manufacturers are developing facilities for these products. This standard has been formulated to cover the various technical requirements.

For all the tests specified in this standard (chemical/physical/others), the method as specified in relevant ISO Standard may also be followed as an alternate method.

The composition of the Committee responsible for the formulation of this standard is given in Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

HOT DIP ALUMINIUM-ZINC ALLOY METALLIC COATED STEEL STRIP AND SHEET (PLAIN)

1 SCOPE

1.1 This standard covers the requirement of continuously hot-dip aluminium-zinc alloy metallic coated steel strip and sheet (plain) specification of 0.25 mm to 1.5 mm thick base steel.

1.2 Sheets and coils are produced by uniformly coating over both surfaces of cold rolled steel coil as base.

1.3 This standard covers requirements for steel grades, coating classes and surface finishes as follows:

a) Normal (N)/Skin-passed (S);
b) Aluminum/Zinc coating classes; and
c) Structural steel grades.

2 REFERENCES

The following standards contain provisions, which through reference in this text constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreement based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
513 : 2008	Cold reduced low carbon steel sheet and strip (*fifth revision*)
1608 : 2005	Metallic materials — Tensile testing at ambient temperature
1956 (Part 4) : 1975	Glossary of terms relating to iron and steel: Part 4 Steel sheet and strip (*first revision*)
8910 : 1978	General technical delivery requirements for steel and steel products
12860 : 1989	Metallic coatings thickness by X-ray fluorescence technique method — Determination
IS/ISO 16163 : 2005	Continuously hot-dipped coated steel sheet products — Dimensional and shape tolerances

3 TERMINOLOGY

For the purpose of this standard the definition given in IS 1956 (Part 4) and the following shall apply.

3.1 Cold Reduced Sheet or Coil — Cold reduced sheet or coil prior to hot-dip coating process.

3.2 Thickness of Sheet — Thickness of cold reduced sheet in cut-length or coil form without any coating on it. This is also termed as BMT (base metal thickness). In case of coated steel, it is measured after removing the coating. This is the thickness on which structure is designed and should be used while ordering the coated steel.

3.3 Coated Thickness — Thickness of coated sheet in cut-length or coil form. This is also termed as TCT (total coated thickness).

3.4 Aluminium/Zinc Alloy Coating — A hot-dip coating composed of 55 percent aluminium, balance zinc and incorporating minor addition of control elements. This type of coating normally has a post treatment for perseverance.

3.5 Surface Finish

3.5.1 *Normal*

The un-altered 55 percent aluminium zinc crystal structure that occurs during solidification of a hot-dip coated steel sheet. It will be denoted by N (Normal).

3.5.2 *Skin Passed*

The material is skin passed for improved surface condition to make it suitable for subsequent painting and it will be denoted by S (Skin passed).

3.6 Coating Class — The designation of coating class shall include a set of characters as follows:

Aluminium zinc alloy shall be indicated by the prefix 'AZ', followed by a number representing the minimum coating mass, in g/m^2, of sheets or strips (total for both surfaces determined by triple spot test/on-line X-ray fluorescence method.

Example : 'AZ150'

3.7 Steel Grade — The designation of steel grade shall include a set of characters as follows:

a) First and second characters: to indicate yield strength 'YS'.
b) Third, fourth and fifth characters: to represent the minimum yield strength in MPa, namely

'250', '300', '350', '450' and '550'.

Example: 'YS 550'

3.8 Surface Treatment Condition — Coated steel surface maybe given passivation treatment or other additional coating. This condition will designated as 'T'.

4 SUPPLY OF MATERIAL

The general requirements relating to supply of aluminium-zinc alloy metallic coated steel strip and sheet (plain) shall conform to IS 8910.

The coated steel to this standard may be supplied in surface finish normal (regular spangle)/skin-passed based on mutual agreement between the purchaser and the supplier.

5 MANUFACTURE

5.1 The base metal of cold-rolled low carbon steel strip for aluminium-zinc alloy metallic coated steel strip and sheet (plain) shall be as per IS 513.

5.2 Coating is done by dipping the cold-rolled strip in a bath of molten aluminum, zinc and control elements at a temperature suitable to produce a complete and uniformly adhering aluminium-zinc alloy metallic coating.

5.3 Coated surface may be given treatment like temper mill pass, surface passivation or other coating for different beneficial reasons.

6 PRODUCT DESIGNATION

The product designation shall follow the following sequence :

a) Number of this standard (IS);
b) Steel grade;
c) Coating class;
d) Surface finish; and
e) Surface treatment condition (passivated, other coating, etc).

Example: IS 15961 -200Y YS550 AZ150 NT

7 CHEMICAL COMPOSITION

7.1 Requirements for chemical composition of the base steel shall be as per IS 513.

7.2 One sample/heat of the base metal to be tested after stripping the coating from it.

8 TENSILE TEST

8.1 Test Piece

The tensile test piece shall be cut parallel to the direction of rolling.

8.2 Testing Frequency

Sample shall be collected and tested for each mother cold-rolled coil and the part thereof as per agreement between the supplier and the purchaser

8.3 Testing

When tested as per IS 1608, the tensile properties should be as per the Table 1. (Testing is preferred on dumb-bell shaped tensile samples.) Width of the dumb-bell to be 12.5 mm for 50 mm L_0 and 20 mm for 80 mm L_0. Testing shall be carried out at ambient temperature between 10 and 35°C.

Table 1 Mechanical Properties (*see* Note 1)

Sl No.	**Grade Designation**	**Yield Strength** MPa *Min* (*see* Note 2) MPa	**Tensile Strength** *Min* MPa	**Minimum Percent Elongation** (*see* Notes 3 and 4)	
				L_0-50 mm	L_0-80 mm
(1)	(2)	(3)	(4)	(5)	(6)
i)	YS 250	250	320	25	22
ii)	YS 300	300	340	20	18
iii)	YS 350	350	420	15	14
iv)	YS 450	450	480	10	9
v)	YS 550	550	550	—	—

NOTES

1 Test specimen to be tested with coating intact, in alignment with international norms the base metal thickness will be used for calculation of strength.

2 The yield strength is the lower yield stress. If well defined yielding is not obvious, then 0.2 percent proof stress should be determined.

3 L_0 stands for original gauge length.

4 Applies to test piece equal to or greater than 0.60 mm thick.

9 COATING TEST

9.1 Triple spot test to be done by X-ray fluorescence method (*see* IS 12860) or weight loss (Gravimetric) method to comply the requirement of this standard. The weight loss test shall be conducted as per Annex A. The minimum coating weight shall be as per Table 2 when tested as per **9.2** to **9.7**.

9.2 One set of three samples each at least 50 × 50 mm^2 or 50 mm diameter shall be selected at random from one sheet for every lot of 1 000 sheets, or part thereof. In case of material supplied in coil form, one set of three samples each of 50 × 50 mm^2 or 50 mm diameter shall be selected from one end of each coil lot. However, if there is any process interruption or change in coating weight or change in grade, then coating shall be tested each change/interruption.

9.3 This set of three samples in total shall be taken one each from the middle of the width of the sheet, and one from each edge of the sheet. The samples from extremities, diagonal or from the side of the sheet shall not be closer than 25 mm from the edge of the sheet.

9.4 One Surface Single Spot Coating Mass

The minimum coating mass on any one surface of any of the three specimens used for triple spot test.

9.5 Single Spot Coating Mass

The minimum coating mass on any one of the three specimens used for triple spot test.

9.6 Triple Spot Coating Mass

The average of three specimens selected from a sample representing the original cross-section of the sheet and strip.

9.7 Differential Coating

A coating which has a substantially different coating mass on each side of the steel sheet or strip. This shall be as per agreement between the purchaser and the supplier.

Table 2 Coating Class and Coating Mass

(*Clause* 9.1)

Sl No.	Coating Class	Minimum Coating Mass, g/m²		
		Total Both Surfaces		One Surface
		Triple Spot	Single Spot	Single Spot
(1)	(2)	(3)	(4)	(5)
i)	AZ200	200	180	80
ii)	AZ150	150	135	60
iii)	AZ100	100	90	40
iv)	AZ70	70	63	28

NOTE — Coating weight other than the above shall be a matter of mutual agreement between the customer and the supplier.

10 COATING ADHESION TEST

One test specimen per coil is to be tested from any part of the sample. Minimum test specimen width shall be 50 mm. Both surfaces of the test specimen shall be capable of being bent 180° around a mandrel with diameter specified in following table without flaking of coating. Failure of coating within 5 mm of the edge of the test specimen shall be disregarded. This will be in accordance with Table 3.

11 FREEDOM FROM DEFECTS

11.1 Plain sheets and coils shall be reasonably flat and free from bare spots, holes, tears and other harmful defects.

Table 3 Coating Adhesion

(*Clause* 10)

Sl No.	Steel Grade Designation	Diameter of Mandrel in Terms of Thickness (t) of the Product Coating Class	
		AZ200	AZ70/AZ100/AZ150
(1)	(2)	(3)	(4)
i)	YS 250	t	0
ii)	YS 300	t	t
iii)	YS 350	t	t
iv)	YS 450	$2t$	$2t$
v)	YS 550	$2t$	$2t$

NOTE — 0 indicates that the coated sample is bent flat on itself.

11.2 However, coils may contain some abnormal imperfection which may render a portion of the coil unusable since imperfections in the coil cannot be removed as in the case with cut length.

12 MASS

The actual mass of the sheets or coils shall be mentioned in 'kg' or '*t*'.

13 DIMENSIONS, SHAPE AND TOLERANCES

13.1 Coil Internal Diameter

Unless otherwise agreed, internal diameter of coils shall be 508 mm (±10 mm).

13.2 Length Tolerance

In the case of sheet — No sheet shall be smaller in length than specified. Tolerance on length on plus side shall be 15 mm or 0.5 percent of length, whichever is greater.

13.3 Width Tolerance

Width of the finished product shall not be smaller than specified. Plus side tolerance on untrimmed width shall be 10 mm. In case of trimmed width it will be plus 3 mm, *Max*.

13.4 Thickness Tolerance

The tolerance on thickness of sheet and coil shall be as per IS/ISO 16163.

13.5 Camber

Minimum camber values for coils and sheets shall be as given in IS/ISO 16163.

13.6 Deviation from Squareness (Out-of Square)

The diagonal distance between opposite corners of any sheet shall not differ by more than 10 mm.

13.7 Deviation from Flatness (Steepness)

This will be in accordance with Table 4.

Table 4 Flatness Tolerance

(*Clause* 13.7)

Steepness Percentage	
Class A (1)	Class B (2)
1.2	0.5

NOTE — Class A tolerance, where length between the points of contact is less than 1 000 mm, the steepness percentage will be 1.

14 RE-TESTING

When a part of the test results for physical properties fails to comply with the requirement, a re-test (two more sets of test samples shall be taken for specific test requirements from the same lot) on the relevant items may be carried out to determine whether it is acceptable or not. If any of the re-test samples fail to meet the test requirements of this standard, the lot represented by the sample shall be deemed as not conforming to this standard.

15 PACKING

Coils/Sheets should be suitably packed to avoid any transit/handling/storage damage.

16 MARKING

16.1 The following shall be legibly and indelibly marked on the top of each coil or package of sheets or shown on a tag attached to each coil or packet:

a) IS No. of this standard;
b) Manufacturer's name or trade-mark;
c) Material identification/coil number/packet number/batch number, etc;
d) Product dimensions;
e) Number of sheets or mass;
f) Steel grade;
g) Coating class; and
h) Date of manufacture.

16.2 BIS Certification Marking

The material may also be marked with the Standard Mark.

16.2.1 The use of the Standard Mark is governed by the provisions of *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

ANNEX A

(*Clause* 9.1)

METHOD OF COATING WEIGHT DETERMINATION BY WEIGHT LOSS METHOD

A-1 CHEMICALS AND APPARATUS REQUIRED

a) Hydrochloric acid (1+1) — Mix 500 ml of HCL (sp gr.1.19) with 500 ml of reagent water;
b) Reagent water shall be prepared by distillation ion exchange/continuous electro deionisation/ reverse osmosis/electro-dialysis or combination thereof;
c) Solvent naphtha;
d) Alcohol;
e) Weighing balance (least count 0.01g minimum); and
f) Dryer.

A-2 PROCEDURE

Clean the accurately prepared specimens by washing with solvent naphtha (or other suitable solvent), and

a) rinse with alcohol, and dry thoroughly;
b) determine the weight (mass) of the specimens individually to the nearest 0.01 g;
c) immerse each specimen in the stripping solution and allow remaining there until the violent evolution of the hydrogen has ceased, and only few bubbles are being evolved. This requires 15 to 30 s. The same solution may be used repeatedly until the time for required for stripping becomes inconveniently long;
d) the temperature of the stripping solution shall at no time exceed the temperature of 38 °C. After stripping, wash the specimens by scrubbing them under running water, dip in hot water and wipe or blow dry;
e) determine the weight (mass) of the specimens again, to the same precision as in the initial determination; and

f) determine the coating mass as per the following calculation.

When determining coating weight (mass) on one side of sheet material, use the above procedure except the use of stop-off). To protect one side from the stripping medium, a few common examples are acid resistant paints or acid resistant tapes. Apply the stop off to the specimen after weighing initially and remove it before taking weight after the stripping of the coating. There is always a possibility of moisture absorption, so the stop off should not be there during the weight determination. The coating weight on the other side may be determined subsequently without a stop off on the first side.

$$C = [(W_1 - W_2)/\mathrm{A}] \times K$$

where

C = weight (mass) of coating of sheet, in g/m^2;
W_1 = original weight (mass) of the specimen, in g;
W_2 = weight of stripped specimen, in g;
A = area of sheet, in mm^2; and
K = 1×10^6.

ANNEX B

(*Foreword*)

COMMITTEE COMPOSITION

Wrought Steel Products Sectional Committee, MTD 4

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Bharat Heavy Electricals Ltd, Tiruchirapalli	Shri V. Rajasekharan
Central Boilers Board, New Delhi	Representative
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